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ABSTRACT

Microcomputers were introduced into the Scotia Union School District in rural northern California in 1979 when the district superintendent-principal proposed using part of a "forest reserve grant" from the United States Forest Service in California to purchase two microcomputers, one for use in the special education classroom and the other for use in the school office. The paper details the evolution of the acceptance of microcomputers by faculty, students, and the community until the fall of 1984, when there were 15 computers in use in the school. In a 5-year period, the school had gone from being totally untouched by computer technology to having a reputation as one of the leading rural users of microcomputers in the state of California. This assessment of the conditions which led to the expansion of computer technology in Scotia provides insight into that process as it might occur in other rural settings. The case study includes discussions of the community setting; the growth of computer usage in Scotia; its impact on teaching and learning; and future prospects. (THC)

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Scotia, California:

What Difference Do Classroom Computers Make?

Tom Gjelten

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Each year, the U.S. Forest Service in California turns over to local school districts a portion of the income it earns from timber sales and other activities. These "forest reserve grants" can be important to rural California schools, most of which are strapped for resources, but they are one of those funding sources that can make budget planning difficult for rural districts. They come at awkward times, in unpredictable amounts.

In the winter of 1979, there were 240 students enrolled at Scotia Union, deep in northern California's redwood country. The entire district consists of a single K-8 elementary school, so its forest reserve grant was small -- less than $10,000. Superintendent-Principal Verral P. "Buzz" Lincoln was notified of the award in late winter. He had just a few weeks to prepare a proposal for its use. Lincoln, an easygoing, cheerful administrator who believes in consulting with his staff over such issues, eventually agreed to a project for four students with special language problems. The money would go to hire an aide, with about $3000 left for unspecified materials and equipment.

As usual, the timing of the forest reserve grant was less than propitious. Lincoln's application was approved only in April. By the time the money arrived at the district, there were just six weeks left in the school year. Lincoln hadn't made any plans to spend the $3000 budgeted for materials, and he wasn't sure what to do with it.

The money was supposed to go for consumable items, but Lincoln was reluctant to squander it. "I couldn't see spending it on math bingo and things like that," Lincoln recalls.

A trip to San Francisco gave him the idea of buying computers with the money. Lincoln was attending a convention in the city with several Scotia school board members. While there, they saw an impressive demonstration of computer math games by a 15-year old high school student. Lincoln, a born tinkerer, and two of the board members were intrigued by the demonstration and got into a discussion about the possibilities of computers in the classroom. The three skipped convention proceedings and went for a tour of computer stores in San Francisco to see what was available, for what prices. After returning, Lincoln went in to the Radio Shack store in the nearby city of Eureka. He had thought about computers before, but on his first visit to the store, the manager had done little to convince him of the instructional potential of the technology. But on this visit, after what he had seen in San Francisco, Lincoln's interest was piqued. There was as well a new manager, this one with a computer background himself. He gave Lincoln a demonstration that sold him instantly. At the next board meeting, Lincoln proposed that he spend the remaining forest reserve money on two new micro-computers, one for use in the special education classroom and the other to use in the school office.
The idea was well received; some of the school board members, Lincoln recalls, used computers in their work at the local

lumber company, and they supported Lincoln's argument that the purchase would be a sound investment. The proposal was approved, and Lincoln ordered two TRS-80 Model I computers from the local Radio Shack dealer. A few months later, they were replaced with Model IIIs.

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The story of how micro-computers came to Scotia Union is typical of the way they've entered thousands of rural schools across the country. There was no grand design or avant-garde inspiration, only an enterprising administrator with some extra money to spend and an interest in new technology. Scotia is an exceptional community in many respects, but its school has most of the same inherent strengths and weaknesses as other small rural schools in the U.S.

But in this school, micro-computers were an especially big hit. By the fall of 1984, there were 15 computers in use at Scotia. Every student in the school, from kindergarten through 8th grade, was working on a computer at least once a week, and all Scotia teachers had made computer exercises a standard part of their classroom routines. In a five-year period, the school went from being totally untouched by computer technology to having a reputation as one of the leading rural users of micro-computers in the state of California.

As an extraordinary achievement in an ordinary setting, the growth of computer usage in Scotia is an instructive case. The obvious question is, How did it happen? An assessment of the conditions leading to the expansion of computer technology in Scotia should provide insight into that process as it might occur in other rural settings. This is not an unimportant issue. A 1983 National Academy of Sciences study reported that student exposure to computers is much lower in rural areas than in either urban or suburban settings. That could be due to disparities in resources -- or there may be barriers within rural schools themselves that must be overcome if computers are to be widely used. The availability of an adequate support system, including technical expertise, staff training opportunities, and quality software, is clearly a factor that has special significance in a rural setting. All these points should be illuminated by the Scotia example.

In addition, a case study of the Scotia experience with micro-computers can provide broader insights into the impact of the technology in any school setting. Because it is small and relatively self-contained, the Scotia school is in some ways a laboratory for the study of school change. Between 1979 and 1984, the widened use of computers was clearly the highest priority of instructional improvement efforts at Scotia: No other reform idea rivaled it. The school is therefore an ideal place to see the direct effects of microcomputers on work and learning.

The need for such a study is readily apparent. Between June 1981 and June 1984, according to one recent study, the number of computers in American public schools grew from 33,000 to 630,000 -- a stunning increase of 2000 percent in just three years. This explosive growth has been accompanied by impressive claims about the promise of computers in the classroom as a teaching tool. There have also been sobering reports that the technology is being put to inefficient use at best and harmful use at worst. The example of Scotia suggests that computers can make a difference in classrooms, but it depends entirely on the skill and imagination with which the technology is presented.

The community setting: No reward for non-conformists

Buzz Lincoln starts every day at 7 a.m. with breakfast at Scotia's one cafe, which sits next to the Pacific Lumber sawmill in the center of the village. It's a custom Lincoln shares with a dozen or so cafe "regulars". Each has a reserved place along the counter, and every morning there's a lively conversation among them over the latest local news. Almost all the men other than Lincoln work for Pacific Lumber, or P-L, as everyone in Scotia calls the company. They come to the cafe before work, or on their breaks, so their arrival and departure is dictated by their work schedule at the sawmill. The cafe fills and empties at each blow of the sawmill whistle. Buzz Lincoln is one of the few who can linger.

"I'm kind of unique here, in that I don't work for the company," Lincoln says. It's a notable understatement. Scotia is a true company town, one of the few remaining in the United States. Pacific Lumber owns everything: the cafe, the grocery store next to it, the hotel across the street, even the two local churches and the school building. Every house in town belongs to the company, which is why they're identical in construction and all in the same well-kept condition. They're reserved for P-L workers and managers. Since there are no other homes available in Scotia, P-L employees make up virtually the entire population of 1100. Buzz Lincoln is an exception. As the superintendent/principal, he's employed by the public school district, not the company, but P-L has always provided housing for the town's ministers and school administrator.

The company also maintains all the homes and public buildings. When the furnace at the school breaks down, Buzz Lincoln calls a company repairman. When a house needs to be repainted, a company crew comes by to do the job. The company has its own water and sewage department, its own gardening and garbage removal service, and its own construction operation. The whole system was born of necessity: When the company began its lumber operation around the turn of the century, the redwood forests around Scotia were so dense that the place was virtually cut off from the outside world. The company had to create a self-contained community, complete with all the essential services.

Over the ensuing years, P-L executives say they've continued running the town, even at a loss, in order to keep a good crew of workers. Turnover, in fact, is very low. But that explanation doesn't quite capture what Scotia has come to mean for Pacific Lumber. The company is not only the single employer in Scotia; as the owner of the entire town, it maintains a measure of authority over the residents that is unimaginable in other settings. The company decides which employees get to live in town and which will have to find their own housing elsewhere and commute to work. It decides who gets the nicest, biggest houses and who must settle for smaller, older houses.

There are obvious advantages to living in Scotia: Rent is low, utilities are free, there are no taxes. The company will maintain a house generally the way a tenant wants it. In times of emergency, such as a flood or earthquake, the company's rescue response is as generous and probably quicker than what a local government would provide. And with everyone dependent on a single company, a kind of egalitarianism develops. When business slows, workers are shifted to a four-day week in order to share the burden equally and avoid layoffs. So for those who have a good job at P-L and a nice house, Scotia is a secure place to live and work.

But the total dependence on Pacifc Lumber makes Scotia an exceptionally cautious and subdued community, without the diversity or conflict that characterizes a more typical

small town. There is almost no elderly population; once a P-L worker retires, he loses his company housing and must move away. There is little social deviation; alcoholism and crime are rare. The pressure to maintain a low profile and not to take risks or initiative is great. "No one makes waves here," is the observation of one local resident who, like others, wants to remain anonymous.

The school is a step removed from the company town. The teachers do not depend on the company for employment, and unless they're married to P-L workers, they generally have little to do with the company. Ideally, the school is seen (by teachers and townspeople alike) as a neutral place, where children might be challenged to think beyond the predictable affairs of Scotia. Yet the school is inevitably affected by its location and its relationship with Pacific Lumber. The boundaries of the school district place it within the domain of the company. Those who live in the district and send their children to school are those who happen to have company housing. Only a few students do not come from P-L families. The school board, which is freely elected, is made up entirely of P-L employees or their spouses.

It is therefore virtually impossible to divide school politics and business cleanly from company politics and business. Since Pacific Lumber is the only taxpayer, for example, any time the school board might consider a tax increase, it actually means that P-L employees are taking it upon themselves to judge whether the company's taxes should be raised -- a delicate matter,

to say the least. This is further complicated by the school's dependence on the charity of the company. Not only did Pacific Lumber build the elementary school (a modern structure designed in the "open" style of the early 1970s as three interconnected hexagons); the company does all the maintenance and frequently donates equipment and supplies to the school. Given that relationship, it is not easy for school personnel or board members to chance a conflict with company executives.

The same forces, then, that make Scotia a conservative community are also at work in the school. The staff is a closely knit group who have worked together for many years. Most of the teachers have their roots in the local area and are not prone to leave. Stability is valued over innovation; it is not an environment that encourages experimentation. Buzz Lincoln is a natural leader in this setting. He has enjoyed good relations with his staff and fits easily into town life. With his daily breakfasts at the town cafe, a custom that he's followed for several years, he's found a routine that is tuned perfectly to the predictable pace of this regulated community.

The growth of computer usage in Scotia

The computer Buzz Lincoln got for special education teacher Pamela Albin in the spring of 1979 spent its first year in Scotia sitting in a corner of the classroom almost unused. Mrs. Albin had been eager to use the computer in

her teaching when she helped Lincoln prepare a proposal for it, but in the summer of 1979 Lincoln decided to move her to the kindergarten position. The teacher hired to replace her in the special education room had no previous experience with computers and made little effort to learn about them. "He was an excellent teacher," Lincoln says, "he just wasn't too gung-ho about computers." And it wasn't in Lincoln's leadership style to force a reluctant teacher to pursue something that didn't interest him.

Instead, Lincoln spent his time learning to use his own computer in the school office. Through visits to the Radio Shack dealer in nearby Eureka and his own experimentation, he became familiar with the technology and fascinated by the uses to which it could be put. He bought a software package, VISICALC, that allowed him to do many of his most bothersome recordkeeping chores quickly and easily. He learned to put the school's attendance register on computer. After he entered all personnel and student data, he could pull out any list he wanted. He learned to use VISICALC for accounting purposes and put budget information into the computer. With a word processing package, he and his wife Lucille, the school secretary, made mailing labels, typed letters, and prepared school board agendas. "We put the cover on the IBM typewriter and just let it sit there," Lincoln says.

Among staff and school board members, Lincoln began promoting computers with enthusiasm. At one school board

meeting, for example, Lincoln demonstrated how budget planning could be simplified with a computer. "We'd been thinking about giving the staff a five percent pay raise, when someone asked, 'How much would it cost to do six percent?' I said, 'Well, why don't you have a cup of coffee while I figure it out?' And I dial in six percent, and it goes 'brrr', and it's all done. It automatically figures in the fringe benefits, everything. And I go back to the board and say, 'Here it is, here's what it would cost.' All together, we made four major revisions to the budget that night. Before, that would have taken several meetings to do. The board was pleased as all get out."

Even among the teachers, enthusiasm for the new computers developed around an interest in their use for business and office purposes. The first teachers to be impressed were Rich Barsanti, the fourth grade teacher and Lincoln's assistant principal, and his brother Gary, the second grade teacher. The special education teacher who had been cool to computers, meanwhile, resigned. His replacement, Sal Steinberg, was also unfamiliar with computers before coming to Scotia, but became intrigued by Lincoln's demonstrations and was anxious to use the computer that was already installed in his own classroom.

In 1980, Lincoln and the school staff were faced with another decision about how to spend some supplementary school funding. Under the California School Improvement Program, Scotia was given several thousand dollars to use in implementing

an improvement plan that was to be written by a joint group of parents and teachers. At Lincoln's suggestion, the group decided to purchase two additional computers to be installed in the second and third grade classrooms. They proposed that the computers be used for drill and practice in reading, language, and arithmetic. Lincoln had found software packages for those purposes and was ready to help the teachers try them. The school board, meanwhile, agreed to purchase a fifth computer for Rich Barsanti's classroom with the district's own funds.

It was the promise of the technology that sold Scotia teachers and school board members on computers, not firsthand experience in their instructional use, and the early applications in the classroom were not especially imaginative. The drill-and-practice programs were little more than electronic flashcards, and they were strictly supplemental to the regular classroom lessons. Teachers' views on computers depended mainly on how they personally related to the technology. Shortly after Rich Barsanti got his computer, fifth grade teacher Penny Shooop was ~~that~~ told that more supplemental money was available for her use and and that she could choose between a computer and a classroom aide. She chose the aide. "I didn't understand computers," she recalls.

Lincoln was becoming a big promoter of computers, but did not pressure Shoop or other teachers. "I've never said, 'We're going to have computers and by God you're going to use them,'" Lincoln recalled in a 1982 interview.

"Instead, we just put one in the classroom and one in the office and talked about what it was doing for us. Teachers saw how I used it, they got turned on, and pretty soon they wanted one." It worked for Penny Shoop. Before long, her students were asking when they, too, could have a computer in their classroom. She learned how the Barsantis and Sal Steinberg were using their computers, and eventually she personally went before the school board and asked for one for her own classroom. It came in 1982, purchased through a combination of district and PTA funds.

A major problem for Buzz Lincoln and the teachers at Scotia was the lack of staff training activities. The only "expert" in computer education in the area was a Radio Shack consultant who spent two days a month in Eureka as part of his statewide assignment to work with schools. The Humboldt County schools office in Eureka was a logical place to seek help with staff development, especially since it had been designated as one of 15 "technical education centers" established as part of California Governor Jerry Brown's "Investment in People" program. That program, which aimed to upgrade the technological training of California's youth as part of a general effort to promote the development of a high technology economy in the state, provided funds explicitly for staff development and program planning in computer literacy. But Scotia was so far ahead of other schools in the county that its needs exceeded the services available.

In 1981, the county office organized a computer education resource center, but only after Lincoln put heavy pressure on the office to do so. By then, Lincoln had already began working with other schools in the county that showed interest in computer education, and he was preparing to start his own computer education support group. With the help of the county schools office, Lincoln was eventually able to arrange inservice sessions for his teachers through the Radio Shack expert. Lincoln arranged for the consultant to come to the school one night a week for eight weeks to do four-hour workshops for Scotia teachers. This gave them working familiarity with micro-computer technology and the training necessary for them to use commercially prepared programs in various subject areas.

The bulk of staff training, however, was done by Lincoln himself. He describes himself as "naturally inclined towards this stuff" and learned largely through his own trial and error. When teachers had problems with their programs, Lincoln assisted them. On many occasions he would take their program and modify them so they could be put to better use. He would, for example, take a teacher's commercially prepared language arts program and replace words that came in the program with the actual spelling list being used by the Scotia teacher.

Other rural schools in Humboldt County, meanwhile, were showing interest in computer education, and Lincoln soon began doing workshops for teachers across the area. They were

generally introductory, designed to demystify teachers about the technology. Because he was largely self-taught, Lincoln was able to explain computer usage in jargon-free terms. He did not know how to program, and he emphasized that fact in order to convince teachers that it wasn't necessary for them to learn programming to become computer educators. "I'll do a demonstration for teachers," he said in 1982, "showing them all the things they can do in their classrooms with computers. And then at the end, I'll turn and say, 'Are you impressed with everything I've shown you today? 'Neat, because there's no programming involved.'" Lincoln told teachers that as long as they could load and use commercial software programs, they would be fully prepared to begin a computer education program in their own classrooms.

Under Lincoln's guidance, and with the help of the training by the Radio Shack consultant, Rich and Gary Barsanti and Sal Steinberg soon became proficient in the use of their computers and were able to lead other teachers. The Barsantis learned, like Lincoln, to modify their software to fit their own classroom needs and went furthest among Scotia teachers in integrating computer drill work into their regular curricula. Steinberg, meanwhile, used exercises on the computers to help students overcome learning disabilities. He also became the itinerant computer teacher at Scotia, going from room to room to conduct computer awareness classes for students across the entire grade span.

A visit to Scotia in December 1982, three years after computers were introduced to the school, showed a level of computer awareness among the students that would have been remarkable anywhere and was all the more impressive given Scotia's small size and remote location. There were computers in the second, third, fourth, and fifth grade classrooms, as well as in the special education room. Buzz Lincoln estimated that 70 to 80 percent of the students in the school had at least been exposed to computers. His plan was to gradually build upwards through the grades, so a "wave" of students would bring awareness of the technology with them as they moved through the school.

In the classrooms that had a computer, a typical pattern had emerged. Pairs of students were generally assigned at leats one 15 minute practice period per week. The drills in use varied from room to room. The third grade teacher, John Wunderlich, used his computer mainly for reviewing multiplication tables. He said the computer was better than flash cards because the drill was written as a game and had a competitive aspect to it. In addition to the two students at the keyboard at any given time, there would be a crowd of three or four others watching. "I can't wait until 10:15," said a boy named Jeremiah. "That's when I get it."

A girl named Heather reported that her time was 1:15 on Wednesday afternoons. "I don't like that time," she said, "because the boy before me always hogs and won't get off." Wunderlich said the students gave up their recess and physical

education periods in order to work on the computer, and that impressed him. He saw the computer in his classroom primarily as a motivational device. "This could be the one thing that really turns a student on," he said, "and then it could turn him on to everything." His aim with the math drill was "to get kids to stop working on their fingers."

In Gary Barsanti's second grade classroom, each student had about 10 minutes a day to work on the computer. Barsanti had taught everyone how to get a floppy disc and put it in the disc drive, then to use the programs. "I have 28 kids in here," he said, "and there's not one who's afraid of the computer." Barsanti used it mainly for language drills. One program was for vocabulary building; another taught the use of prefixes and suffixes. During one practice period, two girls named Melanie and Emily were working on a contraction drill. After they typed in their names, a message flashed on the screen:

> Today we will learn about contractions.
> We + are = ?
> We + are = we're. (Melissa types in, "we're".)
> Fine! O.K. Now you try it. I'll keep score.
> can + not = ? (Melissa types in, "can't".)
> Right!
> could + not = ? (Melissa types in, "could't").
> Sorry! Could + not = couldn't. Not could't.

The drill continues to the end, when it flashes on the screen, "That's all for now, Melissa and Emily. Your score was 7 right, 3 wrong!"

Barsanti had planned the computer drills to complement his regular language arts curriculum. He taught a lesson to the class first. When they were familiar with it, the students then practiced on the computer. "They don't realize what they're doing," Barsanti said. "They think they're playing a game, when really they're working." He had also put tests and worksheets on the computer. When students typed in their name, it automatically gave them a lesson on their own pre-assigned level. "It's like an extra aide in the classroom," Barsanti said. "I spend very little time supervising their work on the computer."

Barsanti said the main drawback came with students who had severe reading problems. They had trouble following the instructions on the computer screen. This was seen clearly with two boys, Glenn and Eric, playing a game called Word Race. The game is meant for two players; each has a car and advances along the track each time he or she answers a question correctly. Eric's car never got off the starting line, because he couldn't read fast enough to select an answer before the question disappeared from the screen. Barsanti said he was planning to reprogram the drill to extend the time allowed.

Penny Shoop's fifth graders were in the third year of computer usage in 1982. Formally, the students used the technology in much the same way as younger children did. The classroom computer was set up only with math exercises. The children were scheduled to work on it during assigned

periods. But computer play among the fifth graders took on far more advanced forms than in the lower grades. Students created games for each other, sent each other messages, wrote their own programs. Consistent with this development, the students who chose to play on the computer were a select group. Virtually all second and third graders were excited about computer work; among the fifth garders, a core of computer enthusiasts had emerged, ready and anxious to move beyond their classmates.

Their interest in computers had been nurtured in large part by special education teacher Sal Steinberg, who offered an introductory programming class to students who were interested. He began by familiarizing his students with the technology of computers. During one class session, for example, he divided the students into three groups and assigned each a question to answer. The first group had no problem with their assignment, which was to identify the main part of a computer and how it worked. It was the "memory", they promptly agreed, and it was stored in the microchips. The second group also knew their answer: The main input components in a computer, a girl named Sarah announced, are tapes and discs and the keyboard. "You can take the disc away, and there's still something left in the computer," she explained. A boy named Frank had the third group's answer. The main output component, he said, is the video screen.

The session that day was devoted to a review of material already learned. After the discussion of technology, Steinberg

led the class through a discussion of programming statements. These were, the class agreed, a list of instructions that a computer needs if it's to do a particular job. A "remark" statement defined or identified the program to be used. A "let" statement assigned value to a variable. A "print" statement tells the computer what to write on the screen. "Input" statements set up a space on the computer's memory and asks the user to fill it in with something. "Go to" spacements tell the computers to go to a line number in the program and do what it said there.

Steinberg had shown students how, by inputting a succession of statements, they could program their computer to "do tricks". Brandy Hines, a fifth grader, wrote a program that would lead the computer to print out the list of even numbers from 1 to 100:

```
5   REM CREATED BY BRANDY HINES
10  REM 0 TO 100 EVEN
20  LET K=-2
30  LET K=K+2
40  IF K<100 THEN GO TO 30
50  PRINT "THIS IS EVEN BETTER THAN RECESS"
```

For elementary students to have such knowledge of computer programming in 1982 in Humboldt County was remarkable. Buzz Lincoln estimated that Scotia was at least three years ahead of other rural schools in the county, including Fortuna High School, where Scotia students transferred after finishing eighth grade. The high school had a computer classroom in 1982, but no teacher, and the computers were not extensively used. Lincoln took the high school into consideration while

planning how to develop computer awareness in his elementary school. It was part of the reason, he said, for beginning with lower grade students and working up. "My feeling is that it's not necessary to get the eighth graders into computers," he said, "because the high school is just now gearing up. With the preparation the younger students are getting here, they'll be going on to the high school as programmers."

Lincoln had made progress in promoting computers at Scotia in large part because of the support he received from parents and the school board. Parents interviewed in 1982 uniformly agreed it was a good idea for their children to be familiar with computer technology. As one said, "That's what's coming up in life, and they should be ready for it." She was hoping a computer class for parents could be arranged.

Steve Brudney, a school board member who consistently supported Lincoln's drive to bring computers into the school, said it wasn't always so smooth. In the beginning, he said, there was substantial opposition from parents to the widespread introduction of computers in Scotia classrooms. "People didn't want to see their children taught by machines," he said. "They felt it was so impersonal and didn't understand how they were going to be used." The school board was thinking of putting all its School Improvement money into computers in 1980, but were dissuaded by parent opposition and decided to put part of the money into a perceptual motor program.

The opposition was overcome, Brudney said, through education. Cynthia Campbell, the board chairman, credited Lincoln for the conversion of parental attitudes. "It was hard to get by Buzz's enthusiasm," she said. "When people saw how computers were being used," they got excited." She was also impressed by Sal Steinberg's teaching on the computer. "He's opening up whole new parts of students," she said. Campbell and other board members said they were committed to further implementation of the computer program at Scotia, but on a gradual basis. "I think we've been fairly conservative," she said, "and not jumping into it all at once. And I think we should go on like that."

Over the next two years, more computers were purchased. By the spring of 1984, there were 15 computers in all, including at least one in every classroom and one in the library. Scotia teachers were making more regular use of computers in their instruction. Rich Barsanti, who had moved from the fourth to the eighth grade teaching position, had a printer in his classroom. He had taught his students to write their themes on the computer, using a word processing program, and it was in heavy use. He also put history tests on the computer and was using it to supplement his own teaching. He had, for example, found a program called "Lincoln's Decisions" for his social studies class. It summarized facts about Abraham Lincoln's life, explained dilemmas he had faced, and asked students, "What would you have done when faced with this decision?"

Barsanti said he had come to appreciate the special contributions a computer can make to classroom learning. "You've got interaction, immediate response," he said. "It's not something you have to hand in to the teacher, who then has to grade it." Barsanti was also stressing to his students how important computers were in the world of work, in places ranging from auto parts dealerships to greenhouses. He had taken one group to a modern machine tooling shop, where computers actually did mechanical drawing and tool cutting.

Sal Steinberg, meanwhile, had refined his computer instruction to a considerable extent. He was teaching two classes, an awareness class for third and fourth graders and a programming class for fifth through eighth graders. He was supplementing the TRS-80 guide with material of his own, and he had developed his own theory of how instruction in computer programming fit into an overall pedagogical framework. "To me," he said, "programming is thinking. You have to visualize how to get from here to there, with all the steps in between. It's creative -- something that is useful, regardless of whether you use computers."

A lesson he developed for teaching the meaning of "if-then" statements demonstrated his point. Such statements, he told his students, set conditions. Together, they listed examples: If I put my hand on a hot stove, then I will get burnt. If I run to school, then I will be huffing and puffing. If I do my homework and study, then I will get good grades. To introduce

"if-then" programming, he explained how important it was to be able to plan options. He showed students how to make a flow chart, which he described as "a planning session with our minds." As an example, he drew on the chalkboard a diamond, the flow chart symbol for a branch. Inside the diamond, he wrote, "I call my friend on the telephone," then asked the class what might happen. Three possibilities were listed. Off one corner of the diamond was the first: The line is busy, and I call back later. Off another was the second: My friend's mother answers and my friend is not home. I call back later. The third possibility: My friend answers, and we have a delightful conversation. "These are the options," Steinberg said. "Each branch creates new possibilities, and as we write our programs, we will send each branch somewhere." If-then statements, he explained, instruct the computer what to do under particular conditions such as might be laid out in a flow chart.

Buzz Lincoln was pleased with the progress made at Scotia with computers, but was beginning to suspect it had reached its practical limit, at least for the short term. He said he would still like to see 16 or 17 computers in every classroom, so they would be a major part of each student's daily routine, but suspected that the day when that would be possible was still far off. Scotia was still a pacesetter for rural schools, in Lincoln's opinion, but was beginning to fall behind larger urban and suburban schools. "A lot of the districts have gone way beyond us now," he said. "It's hard when you're a

small school. In this district, there's never an abundance of money. It's always a fight to get what you want."

The impact on teaching and learning

It's a rainy day in Scotia, the third in a row. At recess time, the students are restless, but once again they must stay indoors. In the fourth grade classroom, a game of tag suddenly breaks out. But these kids call it PAC-MAN, like the video game. The rows between the desks are like the pathways on the video screen, where PAC-MAN rolls after his prey. The fourth graders dash up and down the rows, changing direction in mid-dash when they see PAC-MAN headed their way, jaws open, ready to eat them, just like in the arcade game at the supermarket.

Video is such a familiar medium for these children that it supplies the metaphors of their play. Under these conditions, computers in the classroom are quickly taken for granted. Scotia teachers emphasize how easy it was for their students to accept the technology. Gary Barsanti, in the second grade, says none of his students is afraid of the computer. Penny Shoop in the fifth grade says her students kept pestering her for a computer until she finally broke down and requested one. Buzz Lincoln is convinced that computers go naturally with all sorts of children, smart and slow, clever and dull. "It's amazing how quickly they get comfortable with it," he says. "They can learn faster than the teacher."

As much as anything, it is this aspect of computer use at Scotia that is impressive. Under the leadership of Buzz Lincoln, computer technology has been entirely demystified. In the beginning, he led by example, showing a personal enthusiasm for the technology that was contagious. He showed that he was unafraid of the computer as a machine, by learning how it worked and how tofix it. He was an endless promoter, so much so that he often seemed to have a one-track mind. When he was asked by the school newspaper in 1982 to name the two things he wanted most for Christmas, his answer was, "more computers and more tapes for the school." He made computers an inescapable part of school life at Scotia, and before long, they fit right in.

The niche is partly recreational. "The kids always ask, 'Can I go play on the computer?'" reports Rich Barsanti. "It's never 'work'." He says they stay after school for extra chances. School board chairman Cynthia Campbell says her son "lives for Friday", when his time on the computer is scheduled. "He gets more out of that than Popeye," she says. Teachers often see the computer in the classroom as an incentive machine; they let students work on it as a reward for getting their work done. Beyond that, the computers at Scotia are widely used to produce electronic flash cards. Many of the computer exercises done by children in the lower grades are routine drills, not much different from the exercises they would find in workbooks.

What is not yet fully accepted is that computer learning is as serious as book learning. The students in Sal Steinberg's programming class don't get credit for it, which puts it on a lower level than band practice. Teachers have in some cases been reluctant to leave their class for computer instruction, and Steinberg must be careful to remind students that their computer class is strictly extra-curricular. "My criterion is that they can't fall behind in their regular subjects," Steinberg says, "or they'll have to stop coming." Rich Barsanti wishes the other teachers had more respect for computer work. "In some cases, kids who seem handicapped can do fantastic things on the computer," he says. "So you need to recognize that students who can't achieve in the classroom can maybe do great on the computer."

The distinction at Scotia between computer play and school work reveals that the technology has been slow to influence clssroom instruction. Scotia teachers generally separate the computer from their own teaching. That is changing, however; as the teacher of a self-contained eighth grade class, Rich Barsanti has the challenge of providing specialized curriculum material to students on a variety of topics. As a computer enthusiast, he has the inclination as well as the opportunity to use the computer as an integral part of his program, allowing him to individualize his curriculum.

The approach followed at Scotia has its wisdom. Teachers are probably well advised to continue to rely on their own proven instructional techniques until they're more familiar

with their computers and have access to quality software programs. If the teachers had launched wholeheartedly into a computer-based instruction, they would in all likelihood have ended up with a stultifying routine of mechanical drill and practice. As it is, computers are changing instructional approaches slowly at Scotia, but at a rate appropriate for the level of computer awareness among the faculty.

The more urgent issue, in any case, is how computers are affecting children's learning. It was this question that most concerned Scotia parents. They feared that their children would be learning at the hands of robots, that human contact would be gone. And it is certainly true that the computers are programmed to "talk" to the children. When a student answers a question correctly, rockets burst across the screen, or a message of praise blinks on and off. Is this "interaction" possibly replacing personal exchanges with the teacher? The danger is that the relationship is mechanical. It depends on students pushing a series of buttons in correct order; the computer cannot respond to the look on a child's face. Some critics have charged that computers make learning less intuitive.

At Scotia, those who use computers the most insist it has <u>increased</u> their contact with children, not decreased it. Sal Steinberg says that computers have brought some turned-off students to life, and thus made them more sociable in school. Buzz Lincoln says one of the reasons he is such a strong supporter

of computers is that they have the potential of reducing the amount of tedious drill routine a teacher must do, thus giving her or him more time to do creative things in the classroom. "If a computer can't do anything else," he says, "it can do all the dull things a teacher shouldn't have to do. A computer can do flash cards for hours and never get tired or cranky. I'm all for anything that will take the strain off a teacher." He argues that the more teachers use a computer for these tasks, the more personalized their classrooms will become. Observations of computer use at Scotia support some of these claims. The typical classroom computer scene was not a quiet and solitary student staring into a video screen. It was a cluster of students grouped around a terminal, shouting out answers or giving instructions to the students whose turn it was to work the keyboard.

Some students, moreover, are going far beyond mechanical work on the computer. Once Sal Steinberg taught them how to program, they began creating games for each other and using the computer as a means of communication with their friends. Some examples:

```
5   REM CREATED BY MELISSA
10  CLS
20  INPUT "WHAT IS YOUR FAVORITE FOOTBALL TEAM";F$
30  PRINT "I LIKE"F$; "TOO.  THEY ARE A VERY GOOD TEAM."
40  END
```

```
5   REM CREATED BY KYRI GLEATON
10  CLS
20  INPUT "WHAT IS YOUR NAME";N$
30  INPUT "WHAT IS YOUR ADDRESS";A$
40  INPUT "WHAT IS YOUR PHONE NUMBER";P$
50  PRINT N$; "LIVES AT ";A$; "  ";P$; "IS THE PHONE
                                          NUMBER."
60  END
```

Steinberg expects to go much futher with such experimentation in the future. He now has in his classroom an Apple computer, which permits him to use the LOGO language, developed at the Massachusetts Institute of Technology for the explicit purpose of helping children learn to program computers, as opposed to being programmed by them.

Update: Looking forward

In the summer of 1984, Buzz Lincoln retired as superintendent/principal at Scotia, after 17 years on the job. It will be an active retirement, he says. Computers are now a passion for Lincoln, and he plans to keep busy as a consultant to schools in the area. He'll be working closely with the county schools office in Eureka, where he owns a house. He has co-authored a teacher's manual with Sal Steinberg, Teaching Beginning Programming in TRS-80 Basic: A Curriculum Guide for Grades 5-8. The book is an outgrowth of supplements Lincoln and Steinberg have made to the Radio Shack guide. It will be the basis for in-service workshops and training sessions in area schools.

Lincoln stayed at Scotia until he had fulfilled his dream, which was to see a computer in every classroom in the school. He leaves the mission of promoting computer use now to Sal Steinberg and Rich Barsanti. They'll miss him. "It's like in baseball," says Barsanti, who's also a coach. "When the star of the team leaves, you feel his loss every day." There is some concern whether the school board will continue to support the expansion of computer use at Scotia. The board

backed Lincoln in his drive to familiarize the students and the faculty with computers, but in replacing him, they chose a candidate with no background in computers and little apparent commitment to their use. That bothered Lincoln, who worries that without strong leadership from the superintendent, the computer program at Scotia will "falter". But Lincoln trained Barsanti and Steinberg well, and they will be able to supply most of the expertise needed in the school. Barsanti plans to teach word processing, and Steinberg will continue his programming classes.

Buzz Lincoln's departure makes this an appropriate moment for assessing the significance of computer instruction at Scotia. One thing is clear: Under Lincoln's leadership, educational improvement was defined as the introduction and use of computer technology in Scotia classrooms. This can be seen in both formal and informal ways. The explicit purpose of California's School Improvement Program is to give local school leaders funding to carry out projects that would, in their opinion, do the most to improve educational quality at their school. At Scotia, SIP funding was consistently used to purchase computers. Lincoln communicated the same priority informally. In scheduling in-service workshops and working with teachers, his constant message was that an expanded use of computers was a good idea, the idea he could most strongly support. Under Lincoln, the energy and resources to support educational improvement were expended almost entirely on the task of promoting computer usage.

This raises the issue of "opportunity cost": What other avenues of improvement have been neglected in order to pursue the computer program so determinedly? Elsewhere in California, a backlash against computers has developed around this issue. A group calling itself the Ad Hoc Committee on Basic Skills Education has argued that money spent on computers could be better used in improving curriculum, teacher strength, and greater emphasis on basic subjects. A similar question must be asked with respect to individual teachers. To the extent that the drive to improve instruction is experienced exclusively as pressure to have and use computers in the classroom, a teacher may be excused from the responsibility to develop in other ways.

This is a dilemma common in small rural schools, where energy and resources are limited and typically used in focused ways. Indeed, there is a strong argument for taking this approach. It probably pays more to do one thing well than to do many things poorly. Doing one thing -- anything -- well gives rise to a sense of pride, spirit, and synergistic energy that would not be generated if improvement efforts were unfocused and mediocrity prevailed.

The question in Scotia, therefore, is not so much whether it made sense to define improvement so narrowly, but whether it was wise to define improvement in this particular way. It is not surprising that the decision was made. First, it was probably the least controversial definition possible. The Scotia community is by nature very conservative. If the school were to move together toward a single ambitious goal, it had to

be one the community could embrace and support, and computers were the natural choice. Broader forces reinforce that priority.

These forces are in part commercial. Computer companies have a substantial interest in selling both hardware and software to schools, and they have energetically promoted (perhaps overpromoted) the importance of computer literacy. Radio Shack is a good example. School sales are important in the company's overall marketing plan, and it has produced a variety of teaching materials, student comic books, and curriculum guides, and trained staff specifically to promote computer use in schools.

In addition, the importance of computer literacy has been promoted heavily by the education establishment and by economic and political leaders. This was especially true in California under the administration of Governor Jerry Brown, who said he wanted schools to augment the three R's with the three C's -- "computing, calculating, and communicating through technology." The Technical Education Centers established in California had the explicit purpose of promoting computer technology in schools. The school leadership in Scotia was thoroughly sold on this idea. In the introduction to the teachers guide for computer programming, Lincoln and Steinberg wrote: "The computer age is upon us, and it is our responsibility -- yes, our duty -- to educate our children to the uses of this new technological development. Our students, who will lead us into the 21st century, have a right to develop this new knowledge. To be computer illiterate in the year 2000 will be the equivalent of being unable to read and write in the 1970s."

It's not entirely obvious thatcomputer literacy is a necessity for Scotia children. Many of the boys will end up working at Pacific Lumber. Others, and most of the girls, will have to leave Scotia to find work opportunities. For them, familiarity with computers will be useful, but how useful is not yet clear. Analysts have observed that most computer-related jobs require only "keyboard competence," not knowledge of basic programming or computer operations.

In any case, the push for more computer education at Scotia is probably justified by the fact that the process of improvement can be more important than the "improvement" itself. Buzz Lincoln, Rich and Gary Barsanti, and Sal Steinberg probably have given more of their energy to their work in the last few years than they would have if there had been no computer push, and their increased energy has had side effects quite apart from the benefits of heightened computer awareness in the school.

The next question is whether what's happened in Scotia could and should happen in other rural schools. The strengths in this setting are real, but not all that rare. What's important here is the combination. The administrative leadership of Buzz Lincoln is combined with the pedagogical inspiration of Rich Barsanti and Sal Steinberg. In the absence of either, the achievements that made Scotia notable would not have occurred. Lincoln had the original idea, found the money, engineered the support of the school board, and brought the technology into the school. AFter that, he sanctioned its use with the full force of his authority and pressured teachers to pursue it.

Barsanti, meanwhile, served as an example for other teachers in his promotion of the instructional merits of computers, while Steinberg showed computer learning could unlock imagination and stimulate creative thinking and communication.

The loss of Lincoln's administrative leadership will surely impede further progress in Scotia, but this is the eternal school improvement problem in rural areas -- how to sustain initiatives after leaders depart. There is no easy solution. An improvement effort is a dynamic process; it can be sustained in one place for a limited time, then it may dissipate. As for the conditions that led people at Scotia to focus on computer education, they are also found in other rural schools. Radio Shacks or other computer outlets are plentiful, growing, and more aggressive than ever in their school marketing. Among the education service agencies such as the county schools office in Eureka, computer education is always a high priority, especially in rural areas where there are compelling arguments to be made for any technology that can individualize teaching and put students in touch with advanced subject material.

But what is most important to understand about the push for computers in Scotia is that it was a course that was locally determined. Many of the benefits that grew out of computer work at Scotia could not be guaranteed to occur in other schools, even if the basic conditions were all met. For that reason, it would probably be unwise for state or Federal education

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authorities to define school improvement in the way it's been defined in Scotia. It is only when schools are able to choose the improvement path that makes most local sense that its full benefits will be realized.

Efforts going into computer education programs could very well be better spent on other projects. In some cases, a major push for computer-based instruction could deaden a classroom, instead of bringing it to life. Even at Scotia, the use of computers has not by itself produced notable changes in most classrooms. What is exciting about Scotia is that the school has made a name for itself. It has achieved a level of computer awareness and skill among its students that is unusual and makes the school exemplary. It is that <u>experience</u>, more than the achievement itself, that may be most valuable.